## REMARKS

Claims 11-14 are pending in this application.

**Claim Rejection - 35 U.S.C. § 103(a)**

Claims 11-14 have been rejected under 35 U.S.C. §103(a) as obvious over Cooney, III et al. (U.S. 6,066,577), in view of Chiang et al. (U.S. 6,309,956). To articulate a *prima facie* case of obviousness under 35 U.S.C. §103(a), the PTO must, *inter alia*, cite prior art that teaches or suggests all the claimed limitations. *In re Royka*, 490 F.2d 981 (C.C.P.A. 1974). To establish a *prima facie* case of obviousness, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. *See, e.g.,* M.P.E.P. § 2142. Coney, III et al. and Chiang et al., alone or in combination, do not teach or suggest every element of Applicants' claims, and there is no suggestion or motivation to combine the teachings to yield Applicants' invention as presently claimed.

The pending independent claim recites "[a]n integrated circuit comprising an interconnect structure, said interconnect structure comprising a dielectric layer, said dielectric layer comprising at least a portion of a hard mask layer, the hard mask layer comprising a patterned organic polymer film wherein a portion of the patterned organic polymer film is fluorinated."

Cooney, III et al. discloses an integrated circuit structure including an upper fluorine-free barrier layer 28 deposited on a fluorine rich insulating layer 22, prepared by fluorine doping a conventional silicon dioxide or amorphous carbon layer. In the Office Action, it is asserted that the fluorine rich insulating layer 22 is a hard mask layer. In the present application, Applicants define a hard mask layer as "a layer which can be etched selectively to another layer and which therefore can be used as an etch mask to etch said other layer." See page 2, lines 20-22. As discussed in the attached Declaration Under 37 CFR § 1.132 of Mikhail Baklanov, the fluorine rich insulating layer 22 of Cooney, III et al. is incapable of functioning as a hard mask layer, because it is the fluorine rich insulating layer itself that is etched – the insulating layer cannot function as its own hard mask. See Cooney, III et al., col. 5, lines 30-35. Likewise, the upper fluorine-free barrier layer 28 is also unsuitable for use as a hard mask layer to the dielectric layer below due to its small etch selectivity – the barrier layer would be consumed if one attempted to use it as a hard mask during etching. Neither the upper fluorine-free barrier layer 28 nor the

fluorine rich insulating layer 22 of Cooney et al. has any inherent functionality permitting it to be used as a hard mask layer. Cooney, III et al. therefore does not teach or suggest a dielectric layer comprising at least a portion of a hard mask layer, much less a "hard mask layer comprising a patterned organic polymer film wherein a portion of the patterned organic polymer film is fluorinated."

Chiang, et al. discloses an interconnect structure including an organic polymer dielectric 140 (see col. 5, lines 50-53). In the Office Action, it is asserted that it would have been obvious to modify the invention of Cooney with an organic dielectric layer as in Chiang, et al. Applicants strenuously disagree. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). As discussed above, neither the upper fluorine-free barrier layer 28 or the fluorine rich insulating layer 22 of Cooney, et al. has any inherent functionality permitting it to be used as a hard mask layer, and there no teaching to use either layer as a hard mask layer. Likewise, the organic polymer dielectric of Chiang, et al. does not have any inherent functionality permitting it to be used as a hard mask layer, and there is no teaching to use it as a hard mask layer. Neither reference includes any teaching or suggestion as to the desirability of the combination proposed in the Office Action that would yield a hard mask layer from layers that separately have no such functionality. Accordingly, there is no suggestion or motivation to combine the Cooney III, et al. and Chiang et al. to yield Applicants' invention as presently claimed.

Moreover, Applicants have unexpectedly discovered that fluorinated organic polymer films are capable of functioning as an effective hard mask layer for an underlying dielectric layer. "A greater than expected result is an evidentiary factor pertinent to the legal conclusion of obviousness ... of the claims at issue." *In re Corkill*, 711 F.2d 1496, 226 USPQ 1005 (Fed. Cir. 1985). Evidence of a greater than expected result may be shown by demonstrating an effect which is greater than the sum of each of the effects taken separately (i.e., demonstrating "synergism"). *Merck & Co. Inc. v. Biocraft Laboratories Inc.*, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), *cert. denied*, 493 U.S. 975 (1989). As discussed in the attached Declaration Under 37 CFR § 1.132 of Mikhail Baklanov, a fluorinated silicon dioxide layer is unsatisfactory for use as a hard mask layer. While fluorination of a silicon dioxide layer lowers the k-value of the layer,

the incorporation of fluorine in a silicon dioxide layer does not impart to the modified layer the functionality necessary for the layer to function as a hard mask, due to selectivity problems in dry etch processing. Compared to incorporation of fluorine into an organic polymer film, incorporation of fluorine into a silicon dioxide layer is significantly more limited -- a maximum of about 4% fluorine can be incorporated into a silicon dioxide layer. As a result, the difference in etch selectivity of the fluorinated silicon dioxide layer and the underlying silicon dioxide dielectric layer is too small (a mere 10% up to a maximum of 30% difference in etch rate) to permit the fluorinated silicon dioxide layer to function as a hard mask for an underlying silicon dioxide insulating layer. Accordingly, if one were to attempt to use the fluorine rich insulating layer 22 of Cooney et al. as a hard mask layer for an underlying silicon dioxide layer, both the fluorine rich insulating layer and the underlying dielectric layer would be consumed. In contrast, the difference in etch selectivity of the fluorinated organic polymer film and the underlying dielectric layer is substantially higher (a difference in etch rate of from about 8 times to about 10 times; see, e.g., Figure 2 of the pending application), permitting the fluorinated organic polymer film to withstand etch conditions and therefore function as a hard mask layer to the underlying dielectric layer. Accordingly, Applicants respectfully request that the rejection be withdrawn.

**Conclusion**

In view of the foregoing amendments and remarks, it is respectfully submitted that the present application is in condition for allowance. Should the Examiner have any remaining concerns that might prevent the prompt allowance of the application, the Examiner is respectfully invited to contact the undersigned at the telephone number below.

Respectfully submitted,

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Dated: 4/5/05

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